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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

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June 1970

U.S. Training and
Employment Service
Technical Report
S-377 R

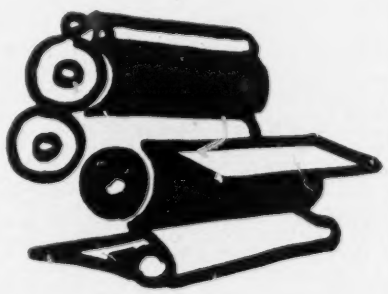
Development of USTES

APTITUDE TEST
BATTERY FOR

# PHOTO-OFFSET LITHOGRAPHY

(print & pub.)
97-.---

U.S. DEPARTMENT OF LABOR
Manpower Administration



ED 069772

Technical Report on Development of USTES Aptitude Test Battery

For . . . . . .

Photo-Offset Lithography (print. & pub.) 97- ---

S-377R

(Developed in Cooperation with the
Minnesota State Employment Service)

U.S. DEPARTMENT OF LABOR
Manpower Administration

June 1970

## FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #2606

# DEVELOPMENT OF USTES APTITUDE TEST BATTERY

For

Photo-Offset Lithography (print. & pub.) 97-.---

S-377R

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Photo-Offset Lithography (print. & pub.) 97-.---. The following norms were established:

| GATB Aptitudes | Minimum Acceptable GATB Scores |
|---|---|
| N - Numerical Aptitude | 90 |
| S - Spatial Aptitude | 95 |
| M - Manual Dexterity | 95 |

## RESEARCH SUMMARY

Sample:

105 male students enrolled in a Photo-Offset Lithography course at the Minneapolis Area Vocational-Technical Institute, Minneapolis, Minnesota. This study was conducted prior to the requirement of providing minority group information. Therefore, minority group status is unknown.

Criterion:

Course grades.

Design:

Longitudinal (sample was tested during early part of training; criterion data were collected at the completion of the course).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations and selective efficiencies.

Predictive Validity:

Phi coefficient = .33 ($P/2 < .0005$)

Effectiveness of Norms:

Only 61% of the nontest-selected students used for this study were good students; if the students had been test-selected with the above norms, 75% would have been good students. 39% of the nontest-selected students used for this study were poor students; if the students had been test-selected with the above norms, only 25% would have been poor students. The effectiveness of the norms is shown graphically in Table 1.

TABLE 1

Effectiveness of Norms

| | Without Tests | With Tests |
|---|---|---|
| Good Students | 61% | 75% |
| Poor Students | 39% | 25% |

SAMPLE DESCRIPTION

Size:

N = 105

Occupational Status:

Students

Training Facility:

Students were enrolled in a 12-month Photo-Offset Lithography course at the Minneapolis Area Vocational-Technical Institute, Minneapolis, Minnesota.

School Selection Requirements:

Education: High school graduate
Previous Experience: No requirement
Tests: No specific tests were used
Other: High school transcript and personal interview

Principal Activities:

The course description is shown in the Appendix.

Minimum Experience:

All students in the sample completed the 12-month training course.

Means (M), Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age and Education

| | Mean | SD | Range | r |
|---|---|---|---|---|
| Age (years) | 20.3 | 5.0 | 17-49 | .082 |
| Education (years) | 12.0 | .6 | 9-14 | .080 |

## EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B were administered between 1963 and 1968.

## CRITERION

The final criterion consisted of school grades converted to grade-point averages by use of the following weights:

| Grade | Weight | Grade | Weight |
|---|---|---|---|
| A | 9 | C+ | 4 |
| A- | 8 | C | 3 |
| B+ | 7 | C- | 2 |
| B | 6 | D (or lower) | 1 |
| B- | 5 | | |

Six instructors are used for the offset printing course. Therefore, the grade-point averages consist of the average of all grades given by all six instructors. The average grade was then multiplied by 10 in order to obtain a desirable criterion range; for example, a student with a C average (3.0) was given a criterion score of 30.

Due to the length of time elapsing between testing and the collection of criterion data it was not possible to obtain either rating scale scores or a rank order of the entire sample. However, a rank order was obtained by three of the instructors on 27 members. By gathering this partial rank order it was possible to evaluate whether grade point averages were measuring ability or other factors such as attitude, cooperativeness, ability to get along with others, etc. All three instructors felt they recalled the 27 individuals well enough to accurately rate them. Emphasis was placed on ranking only in terms of the student's ability to do the work.

The three separate rank orders were then converted to linear scores and averaged to make one rank order to be compared with the grade point averages.

Reliability:

The Pearson product-moment correlation between the two criteria is .84 (significant at the one percent level) indicating that the grade-point averages are highly related to the instructor's evaluation of the student's ability. Therefore, grade-point averages are applicable as a standard against which to compare aptitude scores.

Criterion Score Distribution:

| | |
|---|---|
| Possible Range | 10-90 |
| Actual Range | 21-81 |
| Mean | 45.0 |
| Standard Deviation | 12.9 |

Criterion Dichotomy:

At the time rank orders were obtained, the three instructors also indicated where they would draw a line separating the good and poor students. The consensus was that 10 of the 27 students ranked, or 37 percent, were considered poor students. The highest grade point score obtained by these 10 students was 39. Therefore a criterion cutting score of 40 (a C/ average) was chosen for the dichotomization of the sample into high and low groups. This resulted in placing 39 percent of the combined sample in the low criterion group. For the original sample 42 percent were placed in the low group, and for the second sample 37 percent were placed in the low group. Students in the high criterion group were designated as "good students" and those in the low group as "poor students."

## APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitude P, which does not have a high correlation with the criterion, was considered for inclusion in the norms because the qualitative analysis indicated that the aptitude was important for this training and the sample had a relatively high mean score on that aptitude. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performed)

| | |
|---|---|
| G - General Learning Ability | Needed for grasping fairly technical classroom material and interpreting proof marks. |
| S - Spatial Aptitude | Needed for preparing simple layouts, style of display, and to set and print display jobs. |
| P - Form Perception | Needed for distinguishing differences in type faces and to perceive pertinent detail and to visualize the end product of pictorial and graphical material. |
| M - Manual Dexterity | Needed for setting up, adjusting, maintaining, and feeding a variety of presses such as Platen, Meihle Vertical, etc.; and setting up and operating Cleveland folder, Rosback Auto-stitcher, etc.; also required for operation of cameras and plate making. |

TABLE 4

Means (M), Standard Deviations (SD), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 105

| | | | | |
|---|---|---|---|---|
| G - General Learning Ability | 107.0 | 12.8 | 79-141 | .363** |
| V - Verbal Aptitude | 98.5 | 11.4 | 68-139 | .302** |
| N - Numerical Aptitude | 104.8 | 14.0 | 63-136 | .371** |
| S - Spatial Aptitude | 115.7 | 17.0 | 74-156 | .226* |
| P - Form Perception | 114.2 | 18.1 | 64-162 | .058 |
| Q - Clerical Perception | 111.2 | 13.7 | 77-150 | .206* |
| K - Motor Coordination | 102.3 | 15.8 | 55-153 | .233* |
| F - Finger Dexterity | 99.0 | 21.4 | 49-157 | .113 |
| M - Manual Dexterity | 107.5 | 21.4 | 56-172 | .207* |

*Significant at the .05 level
**Significant at the .01 level

TABLE 5

Summary of Qualitative and Quantitative Data

| Type of Evidence | Aptitudes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | G | V | N | S | P | Q | K | F | M |
| Job Analysis Data | | | | | | | | | |
| Important | X | | | X | X | | | | X |
| Irrelevant | | | | | | | | | |
| Relatively High Mean | | | | X | X | X | | | |
| Relatively Low Standard Deviation | X | X | X | | | X | | | |
| Significant Correlation with Criterion | X | X | X | X | | X | X | | X |
| Aptitudes to be Considered for Trial Norms | G | V | N | S | P | Q | K | | M |

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of aptitudes G, V, N, S, P, Q, K, and M at trial cutting scores were able to differentiate between the 61% of the sample considered good students and the 39% of the sample considered poor students. Trial cutting scores at five point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample; for four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample. The phi coefficient was used as a basis for comparing trial norms. Norms of N-90, S-95, and M-95 provided optimum differentiation for the occupation of Photo-Offset Lithography (print. & pub.) 97-.---. The validity of these norms is shown in Table 6 and is indicated by a phi coefficient of .33 (statistically significant at the .0005 level).

TABLE 6

Predictive Validity of Test Norms
N-90, S-95, and M-95

| | Nonqualifying Test Scores | Qualifying Test Scores | Total |
|---|---|---|---|
| Good Students | 18 | 46 | 64 |
| Poor Students | 26 | 15 | 41 |
| Total | 44 | 61 | 105 |

Phi coefficient ($\phi$) = .33 Chi square ($X^2_y$) = 11.375
Significance Level = P/2 $<$.0005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-37 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A phi coefficient of .22 is obtained with the OAP-37 norms of N-80, S-95, and M-85.

FACT SHEET

Title of Course Curriculum

Photo-Offset Lithography 97-.

Course Summary

The aim of the course is to train the student in the fundamental skills necessary to the production of lithographic printing and to provide practice in employable payroll skills. Students receive a certificate of completion for 12 months of training. Shop work in copy preparation, camera, stripping, plate making, press work and finishing operations are included in the lithographic portion of the course. The short introduction to letter-press includes hand composition, imposition and lockup, and press work.

Course Description

Introduction to Offset Printing: Basic fundamentals of - copy preparation, camera, stripping, plate making, press work and bindery work.

Introduction to Letter-Press Printing: Basic fundamentals of - hand composition (display), lockup and imposition and basic press work.

Advanced Offset Printing I: Advanced techniques in keylining, line and half tone photography, stripping, plate making, press work, bindery machine operation and general maintenance of all equipment used.

Advanced Offset Printing II: New machines, techniques and processes. Production of live jobs for school use. The student receives specialized training in each trade area (the shop is organized on the basis of trade categories).

Cold Type Processes: Basic training in typing advancing to specialized training on the following cold type machines: Selectric, Executive Varityper and Justoriter Recorder & Reproducer. Headlines are produced on the Fotoriter and Filmotype machines as well as with pressure sensitive acetate display type. Copy fitting, copy reading and typography are worked on with the production of body type. The ultimate application of the type produced is in keylines prepared for actual printing production for school use in student litho shop.

Beginning Layout: Basic principles of composition (balance, line, movement, shape and contrast) are stressed as well as their applications to printed layouts and typography.

Copy Preparation: The production or mechanical preparation of art copy for graphic reproduction. The course includes basic drafting techniques, the mathematics of scaling and measurement, keylining, registration and imposition, and miscellaneous techniques.

Chemistry of Lithography: A related science course beginning with the general principles of chemistry and proceeding into specific applications to the areas of plate making, photography, fountain solutions, papers and inks. Physics is involved as it pertains to light and optics.

The subjects in the Photo-Offset Lithography course and the approximate number of classroom hours are as follows:

Length of Course - 12 months

| | COURSE CONTENT | Hours Per Day | Total Hours |
|---|---|---|---|
| SUMMER: | Shop introduction of offset printing copy preparation, stripping, plate making, press work and finishing operations. | 6 | 300 |
| SEMESTER I: | Shop Work - 1st ten weeks in letterpress printing; 2nd ten weeks in offset printing | 3 | 285 |
| | Chemistry of lithography | 1 | 95 |
| | Typing, copy fitting, and copy reading | 1 | 95 |
| | Keylining for lithography | 1 | 95 |
| SEMESTER II: | Shop Work - offset printing | 3 | 285 |
| | Chemistry of lithography | 1 | 95 |
| | Typing, copy fitting, and copy reading | 1 | 95 |
| | Copy preparation (drafting, math, pasteup) | 1 | 95 |
| | | | 1440 |

NOTE: Since this training curriculum prepares students for broad categories of work rather than for a specific job, a six-digit Dictionary of Occupational Titles classification cannot be assigned. The student, upon graduation, will qualify for an entry job leading to one of many different jobs in the printing industry, such as litho-artist, stripper, plate maker, litho-pressman, bindery man, salesman, estimator and many more. These jobs might be with a commercial printer, in-plant printing departments, newspapers, book or magazine publishers, letter services, or trade shops.

Effectiveness of Norms: Only 61% of the nontest-selected students used for this study were good students; if the students had been test-selected with the S-377R norms, 75% would have been good students. 39% of the nontest-selected students used for this study were poor students; if the students had been test-selected with the S-377R norms, only 25% would have been poor students.

Applicability of S-377R Norms: The aptitude test battery is applicable to jobs which include a majority of duties described above.



GPO 898.723